

## CLAIMS

- 1 1. A method of moving droplets, comprising:  
2 providing a liquid phase on a surface;  
3 dispensing a droplet into the liquid phase, the liquid phase being immiscible with  
4 the droplet; and  
5 focusing a beam of light at an edge of the droplet in the liquid phase to produce a  
6 thermal gradient sufficient to induce the droplet to move.
- 1 2. The method of claim 1, wherein the droplet forms a contact angle approaching  $180^\circ$  with  
2 respect to the surface.
- 1 3. The method of claim 1, wherein the beam of light contacts the droplet.
- 1 4. The method of claim 1, wherein the beam of light passes near without contacting the  
2 droplet.
- 1 5. The method of claim 1, wherein the immiscible liquid phase includes an organic liquid.
- 1 6. The method of claim 5, wherein the organic liquid includes decanol.
- 1 7. The method of claim 1, wherein the immiscible liquid phase controls evaporation of the  
2 droplet.
- 1 8. The method of claim 1, wherein the immiscible liquid phase comprises a first immiscible  
2 liquid and a second immiscible liquid; the second immiscible liquid having a greater  
3 density than that of the first immiscible liquid and of the droplet to produce a fluid-to-  
4 fluid interface between the immiscible liquids upon which the droplet sits.
- 1 9. The method of claim 8, wherein the second immiscible liquid includes perfluorinated  
2 silicone oil.
- 1 10. The method of claim 1, wherein the thermal gradient forms within the droplet.

- 1 11. The method of claim 1, wherein the thermal gradient forms in the immiscible liquid  
2 phase.
- 1 12. The method of claim 1, wherein the droplet is aqueous.
- 1 13. The method of claim 1, wherein the beam of light includes an infrared wavelength.
- 1 14. The method of claim 1, further comprising inserting dye into one of the droplet and the  
2 immiscible liquid phase to cause optical absorption by molecules of the dye.
- 1 15. The method of claim 1, wherein a size of the droplet ranges from approximately 30  $\mu\text{m}$  to  
2 1500  $\mu\text{m}$  in diameter.
- 1 16. The method of claim 1, wherein the droplet is a first droplet, and further comprising  
2 depositing a second droplet into the immiscible liquid phase and moving the first droplet  
3 into the second droplet to cause the droplets to fuse and contents of the droplets to mix.
- 1 17. The method of claim 16, wherein each droplet contains a chemical fragment.
- 1 18. The method of claim 16, further comprising detecting a biological molecule in the fused  
2 droplet.
- 1 19. The method of claim 16, further comprising detecting a gene in the fused droplet.
- 1 20. The method of claim 16, further comprising detecting products of gene expression of a  
2 particular gene.
- 1 21. The method of claim 1, further comprising turning the light beam on and off to perform  
2 thermal cycling of the droplet.
- 1 22. An apparatus for moving droplets, comprising:  
2 a surface;  
3 a droplet on the surface;  
4 a light source producing a focused beam of light;

5 means for directing the beam of light at the droplet disposed on the surface to heat  
6 the droplet and cause a thermal gradient to form across the droplet sufficient to induce the  
7 droplet to move across the surface.

1 23. The apparatus of claim 22, further comprising a liquid phase on the surface, the liquid  
2 phase being immiscible with the droplet, and wherein the droplet is surrounded by the  
3 immiscible liquid phase.

1 24. The apparatus of claim 23, wherein the immiscible liquid phase comprises a first  
2 immiscible liquid and a second immiscible liquid, the second immiscible liquid having a  
3 greater density than that of the first immiscible liquid and of the droplet to produce a  
4 fluid-to-fluid interface between the immiscible liquids upon which the droplet sits.

1 25. The apparatus of claim 24, wherein the second immiscible liquid includes perfluorinated  
2 silicone oil.

1 26. The apparatus of claim 23, wherein the immiscible liquid phase includes an organic  
2 liquid.

1 27. The apparatus of claim 26, wherein the organic liquid includes decanol.

1 28. The apparatus of claim 22, where the beam of light includes an infrared wavelength.

1 29. The apparatus of claim 22, wherein the droplet is aqueous.

1 30. The apparatus of claim 22, wherein the droplet includes a dye to cause optical absorption  
2 by the droplet.

1 31. The apparatus of claim 22, wherein a size of the droplet ranges from approximately 30  
2  $\mu\text{m}$  to 1500  $\mu\text{m}$  in diameter.

1 32. The apparatus of claim 22, further comprising a second droplet on the surface and  
2 wherein the directing means causes one of the droplets to move into the other of the  
3 droplets, causing the droplets to fuse and contents of the droplets to mix.

- 1 33. The apparatus of claim 32, wherein each droplet contains a chemical fragment.
- 1 34. The apparatus of claim 32, further comprising means for detecting a biological molecule  
2 in the fused droplet.
- 1 35. The apparatus of claim 32, further comprising means for detecting a gene in the fused  
2 droplet.
- 1 36. The apparatus of claim 32, further comprising means for detecting produces of gene  
2 expression of a particular gene.